

CLAIM AMENDMENTS

Please cancel claim 8 without prejudice or disclaimer.

Please amend claims 1-2, 5-7, 9-15, 18-21, and 24-28 as follows.

1. (Currently Amended) An apparatus, comprising:

a photonic crystal lattice in [[first]] silicon semiconductor material, the [[first]] silicon semiconductor material having a plurality of holes defined in the [[first]] silicon semiconductor material, the plurality of holes periodically arranged in the [[first]] silicon semiconductor material with a hole pitch and a hole radius to define the photonic crystal lattice;

[[second]] polysilicon semiconductor material regions disposed proximate to and insulated from respective inside surfaces of the plurality of holes defined in the [[first]] silicon semiconductor material;

charge modulated regions to be modulated in the [[second]] polysilicon semiconductor material regions, wherein an optical beam directed through the photonic crystal lattice is modulated in response to a modulated effective photonic band gap of the photonic crystal lattice, the effective photonic band gap modulated in response to the charge modulated regions, wherein the effective photonic band gap of the photonic crystal lattice is modulated in response to a refractive index in the polysilicon semiconductor material that is modulated in response to the charge modulated regions.

2. (Currently Amended) The apparatus of claim 1 wherein the effective photonic band gap of the photonic crystal lattice is modulated in response to a refractive index in the [[second]] polysilicon semiconductor material that is modulated in response to the charge modulated regions.

3. (Original) The apparatus of claim 1 wherein the effective photonic band gap of the photonic crystal lattice is modulated in response to an effective hole radius of each of the plurality of holes that is modulated in response to the charge modulated regions.

4. (Original) The apparatus of claim 1 wherein the optical beam has a plurality of wavelengths including a first wavelength and a second wavelength, wherein one of the first and

second wavelengths of the optical beam is allowed selectively to propagate through the photonic crystal lattice at a time in response to the modulated effective photonic band gap of the photonic crystal lattice.

5. (Currently Amended) The apparatus of claim 1 wherein a voltage signal is coupled to be applied to the [[second]] polysilicon semiconductor material regions relative to the [[first]] silicon semiconductor material to induce the charge modulated regions to modulate the effective photonic band gap of the photonic crystal lattice.

6. (Currently Amended) The apparatus of claim 1 wherein a current signal is coupled to be injected through the [[second]] polysilicon semiconductor material regions to induce the charge modulated regions to modulate the effective photonic band gap of the photonic crystal lattice.

7. (Currently Amended) The apparatus of claim 1 further comprising insulating material disposed between the [[second]] polysilicon semiconductor material regions and the [[first]] silicon semiconductor material to insulate each respective [[second]] polysilicon semiconductor material region from the [[first]] silicon semiconductor material.

8. (Canceled).

9. (Currently Amended) The apparatus of claim [[8]] 1 wherein the [[first]] silicon semiconductor material includes crystal silicon ~~and the second semiconductor material includes polysilicon.~~

10. (Currently Amended) The apparatus of claim 1 wherein each of the plurality of holes is filled with material having an index of refraction that is substantially different than an index of refraction of the [[first]] silicon semiconductor material.

11. (Currently Amended) The apparatus of claim 1 wherein capacitive structures are defined by the [[second]] polysilicon semiconductor material regions insulated from the [[first]] silicon semiconductor material.

12. (Currently Amended) The apparatus of claim 1 further comprising an optical waveguide included in the [[first]] silicon semiconductor material through the photonic crystal lattice, the optical beam to be directed through the optical waveguide and through the photonic crystal lattice.

13. (Currently Amended) A method, comprising:
directing an optical beam through a photonic crystal lattice in [[first]] silicon semiconductor material, the [[first]] silicon semiconductor material having a plurality of holes defined in the [[first]] silicon semiconductor material, the plurality of holes periodically arranged in the [[first]] silicon semiconductor material with a hole pitch and a hole radius to define the photonic crystal lattice;
modulating charge concentrations in charge modulated regions in [[second]] polysilicon semiconductor material regions disposed proximate to and insulated from respective inside surfaces of the plurality of holes defined in the [[first]] silicon semiconductor material;
modulating an effective photonic band gap of the photonic crystal lattice in response to the modulated charge concentrations; and
modulating the optical beam directed through the photonic crystal lattice in response to the modulated effective band gap.

14. (Currently Amended) The method of claim 13 further comprising modulating a refractive index in the [[second]] polysilicon semiconductor material in response to modulating the charge concentrations in the charge modulated regions in the [[second]] polysilicon semiconductor material regions.

15. (Currently Amended) The method of claim 13 further comprising modulating an effective hole radius of each of the plurality of holes in response to modulating the charge concentrations in the charge modulated regions in the [[second]] polysilicon semiconductor material regions.

16. (Original) The method of claim 13 wherein modulating the optical beam directed through the photonic crystal lattice comprises selectively blocking one wavelength of the optical

beam from propagating through the photonic crystal lattice in response to the modulated effective band gap of the photonic crystal lattice.

17. (Original) The method of claim 16 further comprising allowing another wavelength of the optical beam to propagate through the photonic crystal lattice while selectively blocking the one wavelength of the optical beam from propagating through the photonic crystal lattice in response to the modulated effective band gap of the photonic crystal lattice.

18. (Currently Amended) The method of claim 13 wherein modulating charge concentrations in the charge modulated regions the in [[second]] polysilicon semiconductor material regions comprises modulating a voltage signal applied to the [[second]] polysilicon semiconductor material regions relative to the [[first]] silicon semiconductor material.

19. (Currently Amended) The method of claim 13 wherein modulating charge concentrations in the charge modulated regions ~~the in in the~~ [[second]] polysilicon semiconductor material regions comprises modulating a current signal injected through the [[second]] polysilicon semiconductor material regions.

20. (Currently Amended) A system, comprising:
an optical transmitter to transmit an optical beam;
an optical receiver; and
an optical device optically coupled between the optical transmitter and the optical receiver, the optical device including:

a photonic crystal lattice in [[first]] silicon semiconductor material, the [[first]] silicon semiconductor material having a plurality of holes defined in the [[first]] silicon semiconductor material, the plurality of holes periodically arranged in the [[first]] silicon semiconductor material with a hole pitch and a hole radius to define the photonic crystal lattice;

[[second]] polysilicon semiconductor material regions disposed proximate to and insulated from respective inside surfaces of the plurality of holes defined in the [[first]] silicon semiconductor material; and

charge modulated regions to be modulated in the [[second]] polysilicon semiconductor material regions, the optical beam received from the optical transmitter and directed through the photonic crystal lattice, the optical beam modulated in response to a modulated effective photonic band gap of the photonic crystal lattice, the effective photonic band gap modulated in response to the charge modulated regions, wherein the modulated optical beam is received by the optical receiver.

21. (Currently Amended) The system of claim 20 wherein the effective photonic band gap of the photonic crystal lattice is modulated in response to a refractive index in the [[second]] polysilicon semiconductor material that is modulated in response to the charge modulated regions.

22. (Original) The system of claim 20 wherein the effective photonic band gap of the photonic crystal lattice is modulated in response to an effective hole radius of each of the plurality of holes that is modulated in response to the charge modulated regions.

23. (Original) The system of claim 20 wherein the optical beam has a plurality of wavelengths including a first wavelength and a second wavelength, wherein one of the first and second wavelengths of the optical beam is allowed selectively to propagate through the photonic crystal lattice at a time in response to the modulated effective photonic band gap of the photonic crystal lattice.

24. (Currently Amended) The system of claim 20 wherein the optical device is coupled to receive a voltage signal to be applied to the [[second]] polysilicon semiconductor material regions relative to the [[first]] silicon semiconductor material to induce the charge modulated regions to modulate the effective photonic band gap of the photonic crystal lattice.

25. (Currently Amended) The system of claim 20 wherein the optical device is coupled to receive a current signal to be injected through the [[second]] polysilicon semiconductor material regions to induce the charge modulated regions to modulate the effective photonic band gap of the photonic crystal lattice.

26. (Currently Amended) The system of claim 20 wherein the optical device further includes insulating material disposed between the [[second]] polysilicon semiconductor material regions and the [[first]] silicon semiconductor material to insulate each respective [[second]] polysilicon semiconductor material region from the [[first]] silicon semiconductor material.

27. (Currently Amended) The system of claim 20 wherein each of the plurality of holes is filled with material having an index of refraction that is substantially different than an index of refraction of the [[first]] silicon semiconductor material.

28. (Currently Amended) The system of claim 20 wherein capacitive structures are defined by the [[second]] polysilicon semiconductor material regions insulated from the [[first]] silicon semiconductor material.